METHOD AND DEVICE FOR PACKING TUBES

BACKGROUND OF THE INVENTION

The present invention relates to a method and to a device for packing tubes which arrive continuously from a production line and by way of a grouping unit are arranged in groups of tubes lying next to one another with a settable unit number of tubes, which correspond to a layer of tubes to be deposited in a box.

Methods and devices which serve for grouping production units and packing them in boxes are known in many embodiments. The procedure with regard to the method as well as a suitable device in order to carry out such a method are in each case very dependent on the type of production units. Thus for example US-A-5,732,536 shows a device by way of which adhesive tapes may be packed into boxes, the German published patent application DE-A-22 00 390 a device for packing for example household paper rolls, or EP-A-350 910 a device for packing flower pots. The handling of the most varied types of products accordingly necessitates various types of methods and devices, and even with products which appear to be of the same type, various problems may arise depending on the size or the design shape, and these problems demand differently adapted methods and devices.

The present invention relates to the packing of tubes. Here, one proceeds from a known device for forming product groups, as is for example known from EP-B-1 114 784. This device is in particular used for forming groups of elongate, cylindrical product units, such as sleeves of tubes or tins which arrive continuously from a production line, and are used for forming product groups with a preselectable unit number. The

formed product groups on a conveying transport belt are brought into a push-off position and from there are pushed into a box in a layered manner. Devices of this type have proven to be extremely successful on the market, and operate with extraordinarily high cycle times. These machines have also been applied for packing tubes. If they are tubes of metal, then the tube body is relatively heavy with respect to the tube head, and the filling into the boxes is accordingly effected without any problem. The situation with tubes of plastic or laminates is more difficult. The ratio of the weight of the head of the tube to the weight of the body of the tube changes depending on the size of the tube. This is particularly the case with middle to small tube sizes. The ratio is additionally unfavorably influenced since the plastic tubes from the production lines are already delivered with the tube cap placed on, since these tubes in the delivered form after packing, are supplied to the respective firms for filling the tubes. Accordingly, the heads of the tubes which are thus delivered are almost always heavier that the sleeve-like tube body.

With all machines which are present on the market today, the tubes are pushed into a suitable box in a layered manner, wherein this box stands or lies on a side wall and accordingly the tubes are pushed into the box in a roughly horizontal direction. If then the tube heads are heavier than the sleeves, then the tubes which are already deposited in the box tend to tilt, so that the open sleeves directed to the grouping unit project slightly upwards beyond the actual plane which corresponds to the respective layer. The result of this is that subsequent layers abut such projecting tubes on insertion, and accordingly a disarrangement occurs, which leads to an immediate interruption of the method. This is extremely annoying, since these packing machines are mostly directly at the end of the respective production lines and thus an interruption on packing

leads to an interruption of production too. As already mentioned, these problems are aggravated due to the fact that the respective closures have already been placed on the tube heads, and these closures furthermore have a smaller diameter than the sleeve itself. This encourages the previously described tilting movement.

A further problem lies in the fact that such plastic tubes and in particular plastic tubes of smaller dimensions very often serve for packing pharmaceutical products with which particular strict cleanliness rules exist. Accordingly, the packing machines described here, just as the production machines themselves are located in suitable clean rooms. This means that the tubes must either be packed in plastic boxes or one must use suitable plastic boxes which need to be lined with bag-like plastic film. Plastic tubes themselves as well as plastic boxes or the bag-like plastic film linings all tend to statically charge, by which means forces may occur by way of the static charging, even without the described tilting effect, which may lead to dislocations of the grouped units.

BRIEF SUMMARY OF THE INVENTION

It is the object of the present invention to provide a method with which in particular tubes of plastic or of laminates may also be filled in plastic boxes or in cardboard boxes with a bag-like plastic lining, without the previously mentioned problems being capable of arising.

A method which achieves this object is to be deduced from patent claim 1. Further advantageous designs of the method are described in the dependent claims 2 to 4. The invention according to patent claim 5 also provides a device by way of which, in particular plastic tubes or tubes of laminates and in

particular also tubes which are heavy at their heads, may be packed in boxes of cardboard or plastic, that is to say cardboard boxes with a bag-like plastic film inlay, without the previously mentioned problems occurring. Further advantageous embodiments of the device are to be deduced from the dependent claims 6 to 10.

BRIEF DESCRIPTION OF THE DRAWINGS

The essential features of the device according to the invention are represented in the accompanying drawing, and these just as the method are described hereinafter with reference to the accompanying drawings. There are shown in:

Figure 1 a schematic arrangement of the device in the region of the transfer of the tubes from a grouping unit in a box;

Figure 2 a perspective representation of a mandrel support, on transfer of the tubes from the grouping unit,

Figure 3 in a schematic lateral view, on dispensing the tubes from the mandrel support into a box;

Figure 4 an enlarged detailed view of Figure 2;

Figure 5 a individual mandrel in a lateral view, and

Figure 6 the same in section, as well as

Figure 7 an individual mandrel with a placed-on tube, in a view perpendicular to the mandrel.

DETAILED DESCRIPTION OF THE INVENTION

With the subsequent method and device to be described, tubes T are to be packed from a grouping unit 1 by way of a packing unit 2 into boxes B which are preferably provided with a bag-like plastic lining. This situation is schematically represented in Figure 1. EP B-1 114 784 is referred to with regard to a more detailed design of the grouping unit. Only the parts of the grouping group which are of interest here are represented in the simplified representation according to Figure 1. The tubes which are continuously supplied from a production line which is not represented here are deposited onto a transport belt 10 which consists of a multitude of product receivers 11 in the form of semi-shells. The tubes T to be packed are supplied in groups by way of a drive 12, preferably a stepper motor, and by way of a slider 13 which may be actuated by way of a piston-cylinder unit 14, are transferred from a transport belt 10 to a packing unit 2.

The packing unit 2 as an essential element has a mandrel support 20 which comprises a plate 21 which by way of a piston cylinder unit 22 may be moved in the direction of the grouping unit 1 and away from this. The piston-cylinder unit 22 with the mandrel support 20 as a whole may be pivoted with a pivot element 23 by 90° from the horizontal position as is represented in Figure 1, into the vertical position. Simultaneously, the pivot element 23 together with the piston-cylinder unit 22 and the mandrel support 20 may be moved back and forth, which is represented symbolically by a rod 24 on which all previously described parts of the packing unit 2 may be moved back and forth. The descriptions with regard to the subsequent figures are referred to with respect to a more accurate design of the mandrel support 20 with the plate 21 and the mandrels which are fastened thereon.

The method according to the invention is hereinafter explained again with reference to Figure 1. The tubes T to be packed which arrive in a continuous manner from a production line which is not shown here, lie in the product receivers 11 on the transport belt 10, and are transported by way of these to a push-off position. The unit number of tubes lying next to one another may be set and the number corresponds exactly to that quantity which corresponds to a layer of tubes to be placed into a box B. If the group of tubes T is located on the transport belt 10 in the correct position, then the slider 13 is activated by way of the piston-cylinder unit 14 and the complete row of tubes T is simultaneously pushed onto the first row of mandrels which are arranged on a mandrel support 20. For this, the plate 21 of the mandrel support 20 was moved by way of the piston-cylinder unit 22 firstly in the direction of the arrow I to the grouping unit 1 and thereafter lowered to the suitable level in the direction of arrow II, so that the already lying group of tubes may all be simultaneously pushed onto the uppermost row of mandrels of the mandrel support 20 by way of the slider 13. After that, the mandrel support 20 is lifted in the direction of arrow III and is then moved somewhat away from the grouping unit 1 in the direction of arrow IV.

Next, a new group of tubes T is again advanced by way of the transport belt 10 into the ejection position, whereupon the mandrel support 20 is again moved in the direction of arrow I to the grouping unit 1, after this is again lowered in the direction of arrow II, and the next layer of tubes is pushed by the slider 13 onto the second row of mandrels, i.e. the second to top row of mandrels. Hereby, the downwards movement is traveled in the arrow direction II downwards only until the already pushed-on layer of tubes lies on the rear free end of the tubes to be pushed on, so that these tubes are guided between the already pushed-on tubes and the product receivers 11

during the displacement. Accordingly, no tilting movement may take place during the push-off. This movement sequence is repeated until the mandrel support 20 is completely loaded (charged) with tubes. After the last row of tubes have been pushed on, the mandrel support is again traveled upwards in the direction of arrow III, and as arrow IV shows, away from the grouping unit 1, whereupon a rotational movement according to arrow V is then effected, so that now all pushed-on tubes T are held in the vertical direction on the mandrel support 2 with the tube head at the bottom, whereupon this support is lowered in the direction of arrow VI and all tubes are simultaneously pushed into the already standing box B. The tubes T which are located in the box B are all simultaneously pushed off from the mandrel support 20 by way of a pull-off mechanism which is yet to be described, and this mandrel support travels back again into its initial position, whereupon a new cycle begins.

In order to achieve an as compact as possible packing of the tubes in the box, one preferably arranges the mandrels on the mandrel support in each case offset by half a diameter with respect to adjacent rows lying above one another. Accordingly, with regard to the method, the transport belt 10 is stopped offset by half the diameter of the tubes, so that the tubes in turn are aligned exactly onto the mandrels. Thus an as compact as possible arrangement of the tubes in the box B may be achieved with this.

Since in particular such plastic tubes or tubes of laminate with a plastic coating are often applied in the pharmaceuticals industry as well as the foodstuffs industry, accordingly high demands are set with regard to the purity and cleanliness. Since cardboard boxes always contain a certain share of paper dust, one increasingly demands the boxes B themselves to be of plastic or to be provided with a bag-like

film lining S. These bag-like film linings S are usually inserted by hand and the edges are put over the flaps of the boxes which are bent laterally down inwardly. A completely correct arrangement of the box with this film lining is hardly possible. This has always led to problems on filling the tubes into such lined boxes. There are various reasons for this. On the one hand such film linings always have a certain static charge and this increases on introduction of the tubes into the box. On the other hand however, until now, the boxes to be filled up were also set up laterally on the [side] edge, and the tubes pushed laterally into the open box directly from the grouping unit 1. Since however the film lining has practically no intrinsic stiffness, accordingly the film always hangs down from the upper side wall. This leads to corresponding problems on introducing the last layer of the tubes. Here the film lining, in practice, is always partly crumpled together and then may be hardly closed. If one attempts to pull smooth the crumpled together film, then the tubes fall out at the same time. With the solution according to the invention, the tubes are placed on the mandrels in an unmovable position. Accordingly, the bag-like film lining may always be pushed directly into the box into the correct end position. Furthermore, with the method according to the invention, the box stands on its base and accordingly the bag-like film lining hangs relatively correctly in the box. The present forces of the static charging no longer continue to play a significant role. What is essential with regard to the correct packing of the tubes into the boxes B is their exact and adequately firm mounting on the mandrels of the mandrel support 20. The subsequent parts of the description are referred to with regard to this.

The mandrel support 20 is represented perceptively in a larger scale in Figure 2. Again one may recognize a part of the

grouping unit 1 consisting of the transport belt 10 with the product receivers 11 in the form of semi-shells. The transport belt 10 runs around a deflection roller 15. One may partly still recognize the angular slider 13. Although in the drawing represented here, the upper three rows of mandrels 25 would already be loaded, these have been omitted for the sake of clarity. One recognizes the supplied group of tubes T which are arranged exactly in the push-on position. The three upper rows of mandrels which would already be loaded with tubes, as a result of this would in the position shown here lie on the group of tubes which lie ready here. In the next step, the slider 13 would then move in the direction towards the plate 21 and would push the group of tubes lying ready, onto the fourth mandrel row from above. This corresponds to exactly the opposite loading sequence of previously known tube packing machines. With this, in each case the tubes are filled from the top to bottom and as a result, the first group of tubes would form the lowermost layer in the box. Here, in contrast the mandrels are supplied with groups of tubes from the top to the bottom.

The actual plate 21 carrying the mandrels is held in a movable manner. A chassis plate 30 is accordingly present through which piston rods of piston-cylinder units 24 pass, and which holds the movable plate 21 carrying the mandrels. The plate 21 carrying the mandrels 21 is provided with suitable bores through which the respective screws engage, and these engage into the rearward end of the mandrels 25. Lateral carrier bars 27 are arranged on the chassis plate 30 along the vertical side edge. Ejection rods 26 are assembled on these lateral carrier bars 27. A distancer 28 in each case is held on both sides between in each case two adjacent ejection rods 26. Accordingly, the ejection rods 26 run parallel and at a distance in each case to two adjacent rows of mandrels 25.

If all mandrels 25 are loaded with tubes T, the chassis plate 30 with the mandrel-carrying plate 21 and the piston-cylinder units 30 is removed from the grouping unit, is traversed upwards and is turned by 90° by way of a pivot element 33. Then, as previously mentioned, the complete mandrel support 20 is lowered and the tubes are moved into the box, and in this position the plate 21 is then pulled towards the chassis plate 30 by way of the piston-cylinder units 29, wherein simultaneously the ejection rods resting at an unchangeable distance on the lateral carrier bars 27 step into operation and pull the tubes from the mandrels. Thereafter the mandrel supports 20 as a whole are moved again into the initial original position. This situation is represented once again schematically in Figure 3. Again the box B standing on its base surface with the bag-like film lining S is evident. A few tubes which have been filled and with their closures V placed thereon are shown filled in the box, and simultaneously also the mandrel support 20 in the already pulled-off position is represented, in which the mandrel-carrying plate 21 is already advanced into its filling position, so that the mandrels 25 may be loaded again.

Although it is not represented in the figures, one would most preferably arrange the mandrels 25 in the horizontal position in each case offset by half the diameter of the tubes to be filled, in order thus to achieve the most compact as possible packing, by which means it is ensured that the tubes remain in the box unmovable in their position.

The mandrels 25 are represented in detail in the Figures 5 to 7. Figure 5 here shows a lateral view whilst Figure 6 represents an axial longitudinal section in the plane E, as is represented drawn in Figure 5. Each mandrel has an essentially rectangular cross section. The end 250 directed to the plate 21 carrying the mandrels is ground in a plane manner. The

oppositely lying free end 251 is ground in a conical manner. The longitudinal edges 252 are rounded according to the inner diameter of the tubes to be accommodated. In total the mandrels 25 are ground with a lower conicity, so that the cross-sectional surface at the end 250 is slightly larger that the cross-sectional surface of the mandrel below the conically ground part. By way of this, it is ensured that the tubes are slightly deformed by pushing on, and thus are held on the mandrels in an elastic manner.

A centric axial bore passes through each mandrel 25. The diameter of this axial bore varies. The axial bore section 255 directed to the end 250 has a smaller diameter. This diameter is slightly larger than the diameter of the fastening screw which engages through the plate 21 into this bore section 255. A bore section 256 with a larger diameter is present at the free end 251 in the direction to the plane end 250. This diameter is designed such that a screw nut 257 may be pressed therein. This may be pressed down to the shoulder 258 which is produced by the change in diameter. The fastening screw with which the mandrel 25 is fastened onto the plate 21 engages into this nut 257.

In Figure 7, this mandrel may be recognized in the view from above, wherein here however a tube T with the closure V placed on is drawn in the placed-on condition. The individually represented mandrel is arranged between two parallel, adjacent ejection rods 26. The lower, open end of the tube reaches up to practically at least approximately the upper edges of the ejection rods 25. The adjacent tubes are drawn in a dashed manner. Here one recognizes that the tubes of the same row as well as the adjacent tubes of the subsequent following row lie on the same ejection rod 26. This is possible because the tubes, as already mentioned, are pushed on, in each case offset by half the diameter. As already mentioned but not shown in the drawing,

accordingly also the mandrels of adjacent rows are arranged offset to one another by the corresponding distance.

First trials with a trial arrangement have already shown that thanks to the method according to the invention and the corresponding device, one may not only operate in a particularly more reliable manner compared to known methods, but that additionally one may also achieve an increase in productivity. This however necessitates the mandrel support 20 with the plate 21 and the chassis plate 30 being present with a doubled design. This may be achieved without any problem by way of arranging both mandrel supports next to one another along the transport belt 10 of the grouping unit 1 and accordingly controlling the transport belt such that alternately, firstly a first mandrel support is completely filled and thereafter the second mandrel support. Of course other arrangements of two mandrel supports are also considered.

LIST OF REFERENCE NUMERALS

B	box
T	tubes
S	bag-like film lining
V	closures
1	grouping unit
2	packing unit
10	transport belt
11	product receivers in the form of semi-shells
12	drive, stepper motor
13	slider
14	piston-cylinder unit
15	deflection roller
20	mandrel support
21	plate
22	piston-cylinder unit
23	pivot element
24	rod
25	mandrels
26	ejection rods
27	lateral carrier bars
28	distancers
29	piston-cylinder unit
30	chassis plate
33	pivot element
250	plane end
251	free end
252	longitudinal edges
255	axial bore section
256	bore section with larger diameter
257	screw nut
258	shoulder